Attorney Docket # 3190-54 Patent

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Examiner: Michael Pervan
Group Art: 2629

In re Application of

Geoffrey S.M. HEDRICK

Serial No.: 10/613,937

Filed: July 3, 2003

For: Method and Apparatus for Illuminating a Flat Panel Display with a Variably-Adjustable Backlight

Mail Stop **Appeal Brief - Patents**
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF

SIR:

This is an appeal pursuant to 37 C.F.R. § 41.37 from the decision of the Examiner in the above-identified application, as set forth in the Final Office Action wherein the Examiner finally rejected appellant's claims. The rejected claims are reproduced in the Appendix A attached hereto. A Notice of Appeal was filed on August 21, 2008.

The fee of $ 270.00 for filing an Appeal Brief (Small Entity) pursuant to 37 C.F.R. § 41.20 is submitted herewith. Appellant requests a three-month Extension of Time of the one-month period to file this Appeal Brief set in the March 9, 2009 Notice of Panel Decision from Pre-Appeal Brief Review. A Petition for the three-month extension of time is enclosed herewith along with the appropriate fee of $555.00 (Small Entity). Any additional fees or charges required in connection

with this application may be charged to our Patent and Trademark Office Deposit Account No. 03-2412.

REAL PARTY IN INTEREST

The assignee, Innovative Solutions & Support, Inc., of applicant Geoffrey S.M. Hedrick, is the real party in interest in the above-identified U.S. Patent Application.

RELATED APPEALS AND INTERFERENCES

There are no other appeals and/or interferences related to the above-identified application at the present time.

STATUS OF CLAIMS

Claims 1-12 have been rejected. Claims 1-12 are on appeal.

STATUS OF AMENDMENTS

There have been no Amendments filed subsequent to the Final Office Action.

SUMMARY OF THE CLAIMED SUBJECT MATTER

The claimed invention is in its broadest sense directed to a method (independent claims 1 and 4) and apparatus (independent claims 2 and 3) for variably illuminating a flat panel display **10** with two different types of illumination based on the level of ambient light. In bright light (*e.g.*, daylight), a fluorescent lamp **16** illuminates the display, while under low ambient light conditions (*e.g.*, nighttime) one or more LEDs **46** (light emitting diodes) illuminate the display. At an intermediate level of brightness (a "transition illumination level"), the two types of light are

variably combined to provide a seamless transition between the predetermined upper and lower ranges of illumination. It is the control of this intermediate level of brightness by monitoring the level of actual light that is generated by and thus illuminates the display that is both the essence of the invention and the functionality that is neither provided nor enabled by the prior art.

Applicant acknowledges that it is well known in the art to utilize a light sensor, such as a photosensor or the like, to monitor the level of ambient light that is incident on a display and to adjust the brightness of the display, based on the monitored level of ambient light, to facilitate the user's ability to comfortably view information that is imaged on the display in both bright (*e.g.*, daylight) and dim (*e.g.*, night) conditions. Thus, for example, it is known to provide high-level backlighting to a liquid crystal or other flat panel display in ambient daylight and to provide low-level backlighting to illuminate the flat panel display in darkness or night conditions, based on the ambient light level that is sensed by such a photosensor or the like. What is *not* taught or disclosed in the art is any way in which to assure that the *transition* between high and low level backlighting or flat panel display illumination, where the different levels of lighting are provided by disparate sources with different operating characteristics, is implemented in an uninterruptedly smooth and seamless manner so as to avoid even momentary interference with a viewer's ability to continuously view and readily discern information presented on the display screen. Indeed, nothing in the prior art even references or appears to recognize the problem to which the claimed invention presents its reliable, elegant and highly advantageous solution.

The inventive method and apparatus are most especially useful in controlling the illumination of a flat panel display on which flight-related information is presented to the flight crew in the cockpit of an aircraft, in which the display illumination level must be maintained – to avoid

overwhelming the flight crew's vision with critical flight information displays that are illuminated with either too much, or too little, or discontinuously varying, light – within a carefully-controlled range while smoothly and uninterruptedly varying the display illumination, most especially as the critical transition between the high light level fluorescent lamp and low light level LED-based illumination is effected, as the ambient light level changes.

The invention utilizes an illumination sensor (which is implemented by a photosensor in the disclosed embodiments) to monitor the actual level of *generated* light that is illuminating the display (*i.e.*, the current display screen illumination level or *brightness*). The monitored level of the brightness of the actual light that is generated by the display is compared to a desired level of brightness of the display and the supply of operating power to the fluorescent lamp and to the LEDs is adjusted so that at all times the proper, intended level of light illuminates the display and that intended light level is varied in an uninterruptedly smooth manner throughout the entire range of illumination which extends between a predetermined maximum illumination level suitable for viewing of the display screen in ambient daylight conditions and a predetermined minimum illumination level suitable for viewing of the display screen in ambient night conditions, and at all levels therebetween (specification at page 13, lines 8 to 18).

The key to the advance provided by the present invention is in its ability to provide an uninterruptedly smooth variation in the display screen illumination level or brightness in the region at and about the so-called "transition illumination level" -- *i.e.*, the region at which the source of illumination for the display screen is transitioned between the high-output fluorescent lamp and the low-output LED(s) (specification at page 14, line 3 to page 17, line 6). The difficulty in illuminating the display screen at specific, smoothly-varying, intended brightness levels in this transition region arises because of certain inherent operating characteristics of fluorescent lamps,

namely *persistence* associated with deactivation of a fluorescent lamp (specification at page 15, lines 8 to 18), and the lag or delay in the emission of light from a fluorescent lamp when the plasma in the fluorescent lamp energizes as power is first applied to the lamp (specification at page 16, lines 4 to 8). To compensate for these characteristics of fluorescent lamps, the present invention (as recited in each independent claim) utilizes a sensor to monitor the *actual* "current display screen illumination level" – *i.e.*, its actual *brightness* – and provides the monitored level to the controller **40** which operates (*i.e.*, supplies electrical operating power to) the fluorescent tube and the LED(s). The controller **40** uses this monitored level signal to operatively "decrease the LED electrical control signal in accordance with the <u>monitored</u> current display screen illumination level and the present <u>desired</u> display screen illumination level to correct for fluorescent lamp persistence at fluorescent lamp shut-off", and to operatively "increase the LED electrical control signal in accordance with the monitored current display screen illumination level and the present desired display screen illumination level to correct for fluorescent lamp start-up delays and fluorescent lamp start-up illumination level variations when the fluorescent lamp is initially powered up". (Emphasis supplied)[1]. In this manner, <u>uninterruptedly smooth variation</u> of the display screen illumination level is assured as the screen illumination level is varied throughout its entire range between its predetermined maximum illumination level suitable for viewing of the display screen in ambient daylight conditions and its predetermined minimum illumination level suitable for viewing of the display screen in ambient night conditions, and most especially at and about the predetermined transition illumination level at which a change between the two (*i.e.*, between the high and low level) sources of display illumination is effected.

---

[1] The quoted language is found in each of independent claims 3 and 4; equivalent limitations are present in independent claims 1 and 2.

In each claimed embodiment, the control of the illumination at the critical transition illumination level is based and dependent on the expressly-recited monitoring of the actual current screen illumination level.

GROUNDS OF REJECTION TO BE REVIEWED IN APPEAL

Are claims 1-12 patentable under 35 U.S.C. §103(a) over U.S. Patent No. 6,447,132 (Harter) in view of U.S. Patent No. 7,242,384 (Yamamoto, *et al.*)?

ARGUMENT

GROUP I (CLAIMS 1-12)

The applied references fail to teach or suggest the claimed invention. Specifically, the references fail to teach or suggest 1) monitoring the light actually generated by a display screen to determine if the display screen is appropriately bright for the operating conditions; and 2) means for smoothly transitioning between a high intensity fluorescent light source and a low intensity LED light source to provide seamless transitioning of the illumination provided to the display screen. Moreover, none of the art of record either discusses or recognizes, let alone presents any solution for, the problems that fluorescent tube persistence or start-up light emission variations cause in preventing a flat panel display screen illumination from achieving an assured smoothly and uninterruptedly varying transition between the LED and fluorescent tube illumination over and throughout the transition region.

Harter

Harter discloses a two-level brightness control for a vehicle head up display **11** (HUD) in which (Fig. 2) a high brightness light source **21** is operated to project an image from an LCD electronic display **26** in bright or daylight conditions, and a low brightness light source **22A, 22B** is operated to project the image under low light and nighttime conditions. Harter teaches that the high brightness light source **21** is preferably "one or more halogen bulbs that produce bright light **21A**" (column 4, lines 20 to 22), and that the low brightness light sources **22A** and **22B** are preferably "one or more fluorescent lights suitable for producing low brightness light" (column 4, lines 45 to 47). Operation of the high and low brightness light level sources is based *solely* on a*mbient light conditions* which are monitored by a light sensor **17** mounted on the outside of the vehicle (column 3, lines 58 to 60) at a location separated and apart from the actual display (*see*, Fig. 1, placement of light sensor **17** with respect to windshield **16** and the user's view).

In Harter, the brightness of the projected image is controlled by using either a high brightness light source **21** or a low brightness light source **22A, 22B**. In certain conditions, a mixture of both sources may be used.

It should also be noted that Harter is not concerned with the use or operation of a flat panel display screen, but rather with a HUD, which has entirely different sorts of operating characteristics and parameters. For example a HUD, since it is intended to be displayed semi-transparently in the user's field of vision, has no user-observable physical display of any kind; it has only a virtual display resulting from the image projector. Thus, it would not be possible for one of ordinary skill in the art upon reading Harter to appreciate the difficulties that arise in reading a *physical* display from reflections on the display screen which are caused by changes in the ambient light, since Harter has no physical display to reflect incident light. Harter is concerned, instead,

solely with problems associated with ambient light that cannot reflect from the display, since *there is no physical, light-reflecting display*; the image is merely semi-transparently projected on the windshield **16** of the user (column 4, lines 11 to 13). For this same reason, Harter does not, and cannot, measure the actual brightness of the display, since there is no physical display to be monitored. Indeed, this would not even be a concern for Harter, since momentary interruptions in variations in the brightness of the semi-transparent image projection -- or, for that matter, even momentary interruptions in the projected image itself - - are likely to be virtually unnoticeable by a viewer and, in any event, will not interfere with the viewer's ability to see and discern the displayed information.

The Examiner acknowledges that, "Harter does not disclose monitoring the current display screen illumination level and providing said monitored level to a display screen illumination level controller that is operable for illuminating the display screen at said determined desired display screen illumination level", as expressly recited in each of applicant's claims, and cites Yamamoto to remedy that deficiency (Office Action, page 5). In truth, Yamamoto fails to do so.

It must also be stressed that Harter totally fails to appreciate the problems associated with the use of a fluorescent light source used for providing varying illumination levels. Harter discloses the possible use of a fluorescent lamp as the high brightness light source (column 2, lines 6-8), and expressly teaches that the *preferred* low brightness light source is a fluorescent lamp (column 4, lines 44-46). Harter fails, however, to appreciate the problems of persistence and delayed start up of fluorescent lights or their effects on the use of such an illumination source in a variable lighting application, or to even acknowledge that such problems exist, and provides no basis for the person of skill to seek a solution to the specific problem identified and addressed by applicant's claimed invention.

Yamamoto

Yamamoto is directed to an image processing device whose objective is:

> "...*to provide an image display device that achieves satisfactory color matching* irrespective of variations in the environmental and other conditions under which an image is observed, variations with time in the characteristics of a color filter, or variations with ambient temperature or with time in the characteristics of a backlight source." (column 3, lines 12 to 18)

Yamamoto differentiates the invention disclosed therein by explaining that, in the prior art:

> "...even if a color management system achieves color matching between images displayed on different personal computers under specific ambient-light conditions and at a given time, it is difficult to maintain the color matching between the images against the deterioration with time of the devices used, because different personal computers differ in the period over which their monitor has been used and in their characteristics." (column 3, lines 1 to 8.)

Thus, the Yamamoto invention provides a system for assuring *consistency* in brightness and chromaticity of color images displayed on different LCD panels or on a single LCD panel as ambient or internal projection conditions or characteristics change – not in *varying* the illumination of the display between disparate illumination sources as in applicant's invention or in Harter.

Yamamoto achieves the desired consistency by including in its system "an optical sensor for measuring how the liquid crystal panel is emitting R, G, and B light", the results of which is used "for varying how R, G, and B light is emitted to display an image on a display panel" to correct "brightness or chromaticity or both of the image" (column 3, lines 19 to 36).

Yamamoto does not address the issue of illuminating the display by the use of multiple disparate light sources of differing intensities and operating characteristics, and is not therefore concerned with any of the issues faced by one of ordinary skill in the art who attempts to do so. Neither is there any teaching or suggestion in Yamamoto that its optical sensor might be

used to provide a smooth transition in display illumination between two disparate, or indeed any two, display illumination sources as in applicant's claimed invention.

The combination

The Examiner's proffered reference combination would not be attempted by one of ordinary skill in the art absent applicant's disclosure and, even if made, would not result in the claimed invention.

<u>One of Ordinary Skill Would Not Utilize Harter as the Starting Point for a Solution to the Problem Addressed by Applicant's Invention</u>

Applicant addresses a problem (and provides a solution to that problem) not discussed or recognized by Harter *or* Yamamoto or any other known prior art – an inability to *smoothly* transition between fluorescent and LED flat panel display *illumination.* Harter does not acknowledge or recognize that such a problem exists, although Harter teaches that high brightness light sources may be transitioned to low brightness light sources over a transition region to provide suitable illumination display levels. Harter totally ignores the difficulty of making that transition a smooth one even though <u>both</u> of Harter's described illumination sources--fluorescent lights, and halogen bulbs -- are known to exhibit both shut-down persistence and start-up delays.

Recognition of a problem not previously appreciated in the art, and then working to solve that problem, is a classic basis for a finding of invention:

> "[I]t should be remembered that in many cases the discovery of a problem is often an essential element in an invention correcting such a problem; and though the problem, once realized, may be solved by the use of old and known elements, this does not necessarily negative invention."

In re Shaffer, 108 U.S.P.Q. 326, 329 (C.C.P.A. 1956)

Here, Harter does not recognize the problem inherent in transitioning between the two (or more) disparate light sources of differing brightness levels, and seems to assume that it is

inherently seamless; applicant teaches otherwise by identifying the problem and addressing it by providing compensating illumination when one of the light sources fails to output light linearly as it starts up and shuts down.

Thus, Harter would not be a logical starting point for one of ordinary skill in the art of illuminating a flat panel display looking to solve the problems addressed by the instant invention.

Even if One of Ordinary Skill in the Art Were to Start with Harter to Provide a Solution to the Problem of Providing a Smooth Transition Between High and Low Brightness Light Sources, He Would Not Look to the Art of Color Matching to Do So

The Examiner contends that it would have been obvious to the person of skill, at the time of applicant's claimed invention, to incorporate the sensor of Yamamoto into the device of Harter "*because it achieves satisfactory color matching* irrespective of variations in the environmental and other conditions under which an image is observed." (Office Action, p. 6, lines 3 to 7, emphasis supplied). However, there is nothing in the record to suggest that one of ordinary skill in the art would be motivated to make this combination, as there is no teaching in the applied art, or elsewhere, of the benefits of making such a combination and, even if made, the resultant combination in no way teaches or suggests applicant's claimed invention.

Assuming, *arguendo*, that one of ordinary skill in the relevant art were to look to Harter as a starting point for a solution to the problem of adjusting the illumination of a display screen to compensate for changes in light incident on the display screen, there is no suggestion in that art that color matching (as is the focus of Yamamoto) would do so. Applicant's claimed method and apparatus has no relation to "color matching", *i.e.*, to ensuring that the colors displayed on a display stay constant over time and under differing operating and ambient conditions.

Applicant solves a problem, and provides a solution, not discussed or apparently recognized by Harter *or* Yamamoto or any other known reference – an inability to *smoothly* and *uninterruptedly* transition between varying fluorescent and LED flat panel display *illumination* under changing ambient light conditions. Why, then, would one skilled in the relevant art even *consider* the Examiner's proffered combination? Only in view of applicant's *recognition* of this problem, and its source, does the Examiner's proffered incorporation, in the device of Harter, of the sensor disclosed by Yamamoto for a completely different purpose than that disclosed by Yamamoto, *i.e.,* "color matching", make *any* sense; the Examiner's proposed combination is nothing more than classic "cherry-picking" of disparate and unrelated elements from the prior art with no teaching, suggestion or motivation in that art to bring them together. The combining of such unrelated elements without any reason or motivation in the prior art is not the work of the mere artisan, it is the work of an inventor.

Even if Made, the Combination Would Not Yield the Claimed Invention

Neither applied reference deals with the overall illumination of a physical display. There is no suggestion, teaching or motivation identified by the Examiner that would direct one of ordinary skill in the art to provide a means for assuring an uninterruptedly smooth transition between two levels of illumination provided by disparate illumination sources, or that it would even be helpful to do so. Harter fails to recognize or appreciate the problems associated with the transition between its different light sources. As to Yamamoto, use of its sensor to control the addition of a second source of illumination to the display, or to vary the amount of light being input from multiple sources (neither of which Yamamoto teaches), would greatly complicate the problem addressed by Yamamoto, *i.e.,* color matching, since the color match would require still further adjustment as the overall display illumination changes -- and utilizing multiple disparate light

sources with different respective color profiles would additionally compound the problem that Yamamoto purports to solve.

The Yamamoto screen brightness measuring sensor is disclosed and intended for use in correcting RGB color variations in the light provided by a *single* LCD panel illumination source; that disclosed use is totally *unrelated* to smoothing the transition between two *different* display panel illumination sources, as in applicant's claims. Why, again, would the person of skill even *consider* incorporating the Yamamoto sensor in the Harter device which includes *multiple* different *backlights* between which the device must transition, and for what purpose? Put another way, what (other than applicant's disclosure) would motivate the person of skill to so incorporate the Yamamoto sensor in the Harter device that it provides the claims-recited functionality to correct for fluorescent tube shut-down and start-up characteristics in the transition to or from LED illumination, when color matching is not in issue?

Claim 3, for example, recites the step of "further varying the LED electrical control signal for predeterminately illuminating the display screen at and proximate the predetermined transition illumination level to one of (i) decrease the LED electrical control signal in accordance with the monitored current display screen illumination level and the present desired display screen illumination level to correct for fluorescent lamp persistence at fluorescent lamp shut-off, and (ii) increase the LED electrical control signal in accordance with the monitored current display screen illumination level and the present desired display screen illumination level to correct for fluorescent lamp start-up delays and fluorescent lamp start-up illumination level variations when the fluorescent lamp is initially powered on...." Each of independent claims 1, 2 and 4 contains a corresponding recitation. *Nothing* in Yamamoto, or in

Harter, mentions or even remotely relates to compensating for fluorescent lamp start-up or shut-down operating characteristics.

There is also no justification for drawing the conclusion that one of ordinary skill in the art would contemplate adding a sensor such as taught by Yamamoto to a virtual display such as in Harter, since there is no direct-view screen in Harter to observe. The projector ("display unit") **14** of Harter is never directly viewed by the user; rather, the user directly views the intended information in the semi-transparent HUD which is subject to an entirely different set of operating and environmental conditions than is the display unit **14**.

Thus, even assuming, *arguendo*, the propriety of incorporating the Yamamoto sensor in the Harter device as the Examiner proposes, there is no teaching or suggestion or motivation in either reference for utilizing that sensor in such a combination to vary an LED electrical control signal to respectively decrease or increase the LED control signal to correct for fluorescent tube persistence (at shut-off) or start-up delays and illumination level variations (at power-on). The Examiner simply proposes to combine the sensor of Yamamoto into the Harter system, without any motivation in the art to do so and without recognizing the very real shortcomings of the references.

CONCLUSION

For the foregoing reasons, it is respectfully submitted that appellant's claims are not rendered obvious by the combination of Harter and Yamamoto and are, therefore, patentable over the art of record, and that the Examiner's rejection should be reversed.

Respectfully submitted,
COHEN PONTANI LIEBERMAN & PAVANE LLP

By /Lance J. Lieberman/
Lance J. Lieberman
Reg. No. 28,437
551 Fifth Avenue, Suite 1210
New York, New York 10176
(212) 687-2770

Dated: July 9, 2009

<u>CLAIMS APPENDIX</u>

1. A method of illuminating a display screen of a flat panel display so as to smoothly and dynamically vary a display screen illumination level between a predetermined maximum illumination level suitable for viewing of the display screen in ambient daylight conditions and a predetermined minimum illumination level suitable for viewing of the display screen in ambient night conditions, comprising the steps of:

monitoring a level of ambient light incident on the display screen to determine a desired display screen illumination level within a range defined between the predetermined maximum and minimum illumination levels;

monitoring the current display screen illumination level by sensing current display screen brightness and providing said monitored level to a display screen illumination level controller that is operable for illuminating the display screen at said determined desired display screen illumination level by:

varying a one-hundred-percent duty cycle fluorescent electrical control signal for operating a fluorescent lamp disposed for illuminating the display screen between a first fluorescent control signal level for illuminating the display screen at the predetermined maximum illumination level and a second fluorescent control signal level for illuminating the display screen at a predetermined transition illumination level less than the predetermined maximum illumination level but greater than the predetermined minimum illumination level and greater than a minimum fluorescent operating control signal level sufficient for maintaining continuous constant-brightness output from the fluorescent lamp at a one-hundred-percent duty cycle, so as to illuminate the display screen at the determined desired display screen illumination level when the determined

desired display screen illumination level is between said predetermined maximum illumination level and said predetermined transition illumination level;

varying an LED electrical control signal for operating at least one light emitting diode disposed for illuminating the display screen between a first LED control signal level for illuminating the display screen at the predetermined transition illumination level and a second LED control signal level for illuminating the display screen at the predetermined minimum illumination level, so as to illuminate the display screen at the desired display screen illumination level when the determined desired display screen illumination level is between said predetermined transition illumination level and said predetermined minimum illumination level;

as the desired display screen illumination level decreases to said predetermined transition illumination level, discontinuing supply of the fluorescent control signal to the fluorescent lamp to discontinue illumination output from the fluorescent lamp, supplying the LED control signal to the at least one light emitting diode, and varying the LED control signal in accordance with the monitored current display screen illumination level to illuminate the display screen at the determined desired display screen illumination level; and

as the desired display screen illumination level increases to said predetermined transition illumination level, initiating supply of the fluorescent control signal to the fluorescent lamp to initiate illumination output from the fluorescent lamp, varying the LED control signal in accordance with the monitored current display screen illumination level to assist the fluorescent tube in illuminating the display screen at the determined desired display screen illumination level as the fluorescent tube is initially

powered, and discontinuing supply of the LED control signal to the at least one light emitting diode when the monitored current display screen illumination level indicates that the illumination output of the fluorescent tube is sufficient to illuminate the display screen to the determined desired display screen illumination level.

2. Apparatus for illuminating a display screen of a flat panel display so as to smoothly and dynamically vary a display screen illumination level between a predetermined maximum illumination level suitable for viewing of the display screen in ambient daylight conditions and a predetermined minimum illumination level suitable for viewing of the display screen in ambient night conditions, said apparatus comprising:

an ambient light sensor for monitoring a level of ambient light incident on the display screen to determine a desired display screen illumination level within a range defined between the predetermined maximum and minimum illumination levels;

a display illumination level sensor for monitoring the current display screen illumination level by sensing current display screen brightness;

a fluorescent lamp disposed for illuminating the display screen;

at least one light emitting diode disposed for illuminating the display screen;

a display screen illumination level controller connected to the ambient light sensor for determining from the monitored level of incident ambient light a desired display screen illumination level within a range defined between the predetermined maximum and minimum illumination levels, and to the display illumination level sensor for receiving the monitored current display screen illumination level, and connected to the fluorescent tube and to

the at least one light emitting diode, said controller being operable for illuminating the display screen at the determined desired display screen illumination level by:

varying a one-hundred-percent duty cycle fluorescent electrical control signal for operating the fluorescent lamp between a first fluorescent control signal level for illuminating the display screen at the predetermined maximum illumination level and a second fluorescent control signal level for illuminating the display screen at a predetermined transition illumination level less than the predetermined maximum illumination level but greater than the predetermined minimum illumination level and greater than a minimum fluorescent operating control signal level sufficient for maintaining continuous constant-brightness output from the fluorescent lamp at a one-hundred-percent duty cycle, so as to illuminate the display screen at the determined desired display screen illumination level when the determined desired display screen illumination level is between said predetermined maximum illumination level and said predetermined transition illumination level;

varying an LED electrical control signal for operating the at least one light emitting diode between a first LED control signal level for illuminating the display screen at the predetermined transition illumination level and a second LED control signal level for illuminating the display screen at the predetermined minimum illumination level, so as to illuminate the display screen at the desired display screen illumination level when the determined desired display screen illumination level is between said predetermined transition illumination level and said predetermined minimum illumination level;

as the desired display screen illumination level decreases to said predetermined transition illumination level, discontinuing supply of the fluorescent control signal to the fluorescent lamp to discontinue illumination output from the fluorescent lamp, supplying the LED control signal to the at least one light emitting diode, and varying the LED control signal in accordance with the monitored current display screen illumination level to illuminate the display screen at the determined desired display screen illumination level; and

as the desired display screen illumination level increases to said predetermined transition illumination level, initiating supply of the fluorescent control signal to the fluorescent lamp to initiate illumination output from the fluorescent lamp, varying the LED control signal in accordance with the monitored current display screen illumination level to assist the fluorescent tube in illuminating the display screen at the determined desired display screen illumination level as the fluorescent tube is initially powered, and discontinuing supply of the LED control signal to the at least one light emitting diode when the monitored current display screen illumination level indicates that the illumination output of the fluorescent tube is sufficient to illuminate the display screen to the determined desired display screen illumination level.

3. Apparatus for illuminating a display screen of a flat panel display so as to smoothly and dynamically vary a display screen illumination level between a predetermined maximum illumination level suitable for viewing of the display screen in ambient daylight conditions and a predetermined minimum illumination level suitable for viewing of the display screen in ambient night conditions, said apparatus comprising:

a display illumination level sensor for monitoring a current display screen illumination level by sensing current display screen brightness;

a fluorescent lamp disposed for operatively illuminating the display screen at display screen illumination levels in a first display screen illumination range defined between the predetermined maximum illumination level and a predetermined transition illumination level less than the predetermined maximum illumination level but greater than the predetermined minimum illumination level;

at least one light emitting diode disposed for operatively illuminating the display screen at display screen illumination levels in a second display screen illumination range defined between the predetermined transition illumination level and the predetermined minimum illumination level; and

a display screen illumination level controller connected to the display illumination level sensor, to the fluorescent lamp and to the at least one light emitting diode and operable for controlling operation of the fluorescent lamp and the at least one light emitting diode to smoothly and dynamically vary the display screen illumination selectively between the predetermined maximum and minimum illumination levels so as to illuminate the display screen at a present desired display screen illumination level by:

> varying a fluorescent electrical control signal for operating the fluorescent lamp between a first fluorescent control signal level for illuminating the display screen at the predetermined maximum illumination level and a second fluorescent control signal level for illuminating the display screen at the predetermined transition illumination level, so as to illuminate the display screen using said operating fluorescent lamp at a display screen illumination level within said first display screen illumination range;

discontinuing supply of the fluorescent electrical control signal to the fluorescent lamp when the present desired display screen illumination level is varied from said first display screen illumination range to said second display screen illumination range so as to shut-off the fluorescent lamp in said second display screen illumination range;

initiating supply of the fluorescent electrical control signal to the fluorescent lamp when the present desired display screen illumination level is varied from said second display screen illumination range to said first display screen illumination range so as to power-on the fluorescent lamp for predeterminately illuminating the display screen in said first display screen illumination range;

varying an LED electrical control signal for operating the at least one light emitting diode between a first LED control signal level for illuminating the display screen at the predetermined transition illumination level and a second LED control signal level for illuminating the display screen at the predetermined minimum illumination level, so as to illuminate the display screen using said at least one light emitting diode at a display screen illumination level within said second display screen illumination range; and

further varying the LED electrical control signal for predeterminately illuminating the display screen at and proximate the predetermined transition illumination level to one of

(i) decrease the LED electrical control signal in accordance with the monitored current display screen illumination level and the present desired display screen

illumination level to correct for fluorescent lamp persistence at fluorescent lamp shut-off, and

(ii) increase the LED electrical control signal in accordance with the monitored current display screen illumination level and the present desired display screen illumination level to correct for fluorescent lamp start-up delays and fluorescent lamp start-up illumination level variations when the fluorescent lamp is initially powered on,

to thereby maintain an uninterruptedly smooth variation in the display screen illumination level as the display screen illumination level is dynamically varied between the predetermined maximum display screen illumination level and the predetermined minimum display screen illumination level.

4. A method of illuminating a display screen of a flat panel display so as to smoothly and dynamically vary a display screen illumination level between a predetermined maximum illumination level suitable for viewing of the display screen in ambient daylight conditions and a predetermined minimum illumination level suitable for viewing of the display screen in ambient night conditions, comprising the steps of:

monitoring a current display screen illumination level by sensing current display screen brightness;

providing a fluorescent lamp disposed for operatively illuminating the display screen at display screen illumination levels in a first display screen illumination range defined between the predetermined maximum illumination level and a predetermined transition

illumination level less than the predetermined maximum illumination level but greater than the predetermined minimum illumination level;

providing at least one light emitting diode disposed for operatively illuminating the display screen at display screen illumination levels in a second display screen illumination range defined between the predetermined transition illumination level and the predetermined minimum illumination level; and

controlling operation of the fluorescent lamp and the at least one light emitting diode to smoothly and dynamically vary the display screen illumination selectively between the predetermined maximum and minimum illumination levels so as to illuminate the display screen at a present desired display screen illumination level by:

varying a fluorescent electrical control signal for operating the fluorescent lamp between a first fluorescent control signal level for illuminating the display screen at the predetermined maximum illumination level and a second fluorescent control signal level for illuminating the display screen at the predetermined transition illumination level, so as to illuminate the display screen using the operating fluorescent lamp at a display screen illumination level within said first display screen illumination range;

discontinuing supply of the fluorescent electrical control signal to the fluorescent lamp when the present desired display screen illumination level is varied from said first display screen illumination range to said second display screen illumination range so as to shut-off the fluorescent lamp in said second display screen illumination range;

initiating supply of the fluorescent electrical control signal to the fluorescent lamp when the present desired display screen illumination level is varied from

said second display screen illumination range to said first display screen illumination range so as to power-on the fluorescent lamp for predeterminately illuminating the display screen in said first display screen illumination range;

varying an LED electrical control signal for operating the at least one light emitting diode between a first LED control signal level for illuminating the display screen at the predetermined transition illumination level and a second LED control signal level for illuminating the display screen at the predetermined minimum illumination level, so as to illuminate the display screen using the at least one light emitting diode at a display screen illumination level within said second display screen illumination range; and

further varying the LED electrical control signal for predeterminately illuminating the display screen at and proximate the predetermined transition illumination level to one of

(i) decrease the LED electrical control signal in accordance with the monitored current display screen illumination level and the present desired display screen illumination level to correct for fluorescent lamp persistence at fluorescent lamp shut-off, and

(ii) increase the LED electrical control signal in accordance with the monitored current display screen illumination level and the present desired display screen illumination level to correct for fluorescent lamp start-up delays and fluorescent lamp start-up illumination level variations when the fluorescent lamp is initially powered on,

to thereby maintain an uninterruptedly smooth variation in the display screen illumination level as the display screen illumination level is dynamically varied between the predetermined maximum display screen illumination level and the predetermined minimum display screen illumination level.

5. A method in accordance with claim 1, wherein said step of monitoring the current display screen illumination level comprises optically monitoring the current display screen illumination level.

6. A method in accordance with claim 1, wherein said step of monitoring the current display screen illumination level comprises optically monitoring the current display screen illumination level using a photosensor.

7. An apparatus for illuminating a display screen in accordance with claim 2, wherein said display illumination level sensor comprises an optical illumination level sensor operable for optically monitoring the current display screen illumination level.

8. An apparatus for illuminating a display screen in accordance with claim 2, wherein said display illumination level sensor comprises a photosensor for optically monitoring the current display screen illumination level.

9. An apparatus for illuminating a display screen in accordance with claim 3, wherein said display illumination level sensor comprises an optical illumination level sensor operable for optically monitoring the current display screen illumination level.

10. An apparatus for illuminating a display screen in accordance with claim 3, wherein said display illumination level sensor comprises a photosensor for optically monitoring the current display screen illumination level.

11. A method in accordance with claim 4, wherein said step of monitoring the current display screen illumination level comprises optically monitoring the current display screen illumination level.

12. A method in accordance with claim 4, wherein said step of monitoring the current display screen illumination level comprises optically monitoring the current display screen illumination level using a photosensor.

EVIDENCE APPENDIX

NONE

RELATED PROCEEDINGS APPENDIX

NONE